Desirably said metallised layer may be used as a heating means for the hose/umbilical by passing an electrical current through the metallised layer in order to prevent (or reduce) temperature reduction in an umbilical. This feature is particularly desirable as temperature reduction increases fluid flow viscosity and thereby reduces flow efficiency.

A further advantage of the metallised layer is that together with a low voltage DC supply a basic signalling facility can be provided between, for example, a platform to platform or from subsea to platform.

Furthermore the metallised layer provides a means of testing for conductive contamination in the liner by performing insulation resistance checks between the metallised layer and the hose bore filled with a conductive fluid. Such testing can be used to confirm the quality of the fluid conduit during manufacture.

The invention also enhances and extends the design life of a liner by substantially eliminating liner contact with sea water thereby preventing the action of hydrolysis and surface chemical attack.

Desirably on low pressure hoses/conduits, where the metallised layer is in the form of a helical wrap tape, such a design can substantially enhance hose burst performance.

Preferably, the fluid conduit is provided with a hose reinforcement structure comprising spiralled or braided fibre reinforcement filaments. Again, such reinforcement techniques will be known to those skilled in the art. Alternatively, there may be bonded or extruded on to said metallised layer, prior to applying a hose reinforcement structure, an extruded or wrapped bonding tie layer so as to retain said metallised layer in substantially close contact with the outer wall surface of the fluid hose thereby to substantially prevent permeation.

Desirably there may be provided an outer jacket or sheath extruded around or wrapped there around in a helical fashion, so as to facilitate handling of said fluid conduit according to the invention.

Where the present invention relates to a multi-conduit umbilical, there may be included in said umbilical conductors

such as electrical cables or optical fibre cables. Again, the structure and composition of such multi-conduit umbilicals will be known to those skilled in the art.

Further preferred features and advantages of the present invention will appear from the following detailed description, given by way of example of some preferred embodiments illustrated with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of a typical thermoplastic hose of the type known in the prior art;

Figure 2 is a perspective view of a first embodiment of a fluid conduit according to the invention;

Figure 3 is a perspective view of a second embodiment of a fluid conduit;

Figure 4 is a perspective view of a third embodiment of a fluid conduit; and

Figure 5 is a view of a multi-conduit umbilical according to the invention.

The prior art of Figure 1 shows a perspective view of a typical thermoplastic hose, indicated by reference number 1, which comprises a hose liner 2 surrounded by a braided fibre

reinforcement structure 4, which structure is surrounded by an extruded outer jacket or sleeve 6.

A fluid conduit according to the present invention is shown in Figure 2, and is indicated by reference number 10. The fluid conduit 10 is formed and arranged for the transportation of chemicals with a small molecular size and shape, for example, methanol, ethanol and hydrocarbon gases and is suitable for use as a single line hose and in a multi-conduit umbilical (not shown). The conduit 10 comprises a generally flexible fluid hose liner 12 encapsulated by a layer of electro-plated metal 14. The electro-plated layer comprises a film having a thickness of nominally 12 microns of metal which is applied to the full length of the fluid hose 12 (or to specific areas where very low permeation is essential, such as found topside in offshore applications). On top of the electro-plated layer 14, there is applied an extruded bonding layer 16 which ties the electro-plated layer 14 to the fluid hose 12. This is an optional layer. On top of this there is a taped or extruded polymer outer liner layer 18 (again an option) which is designed to prevent damage to the metallised layer from adjacent layers, particularly braided layers. On top of these layers is a braided fibre reinforcement 20 of a criss-cross arrangement of the type commonly used in such braided hoses.

An outer jacket or sheath 22 is extruded over the braided fibre reinforcement 20 to facilitate handling of the conduit.

Figure 3 shows an alternative embodiment generally similar to that described above, with reference to Figure 2, and which is described with similar reference numerals with a suffix ' attached. Again, there is provided a fluid hose 12' around which is extruded, or otherwise applied, an adhesive bonding tie layer 13 to which a metallic tape/film layer 14' can be secured. The metallic film 14' is applied on top of the extruded adhesive bonding layer 13' and is spiralled around the hose 12', and which overlaps 15 itself as it is applied (overlapping is not essential for all embodiments). The metallic tape/film layer 14' may be provided with an optional polymer backing (not shown). On top of the metallic tape/film layer 14' there is a taped or extruded polymer outer lining layer 18' and on top of this there is a braided fibre reinforcement 20'. Again an extruded outer jacket or sheath 22' is provided for to provide protection for handling purposes by mechanical apparatus/machinery.

Figure 4 shows yet a further embodiment described with like reference numbers to those used above with a second suffix " attached. A fluid hose 12" has an electro-plated layer 14"

(similar to that described above with reference to Figure number 2) and has on top thereof an extruded adhesive/chemical bonding tie layer 13" to which may be bonded a metallic tape or film layer 14" (again similar to that described above with reference to Figure 3). The metallic tape film layer 14" is provided with an optional polymer backing layer (not shown) to which may be affixed a taped or extruded polymer outer lining layer 18". A second metallic tape/film layer 24" with an optional polymer backing layer is secured spirally to the outer liner layer and is surrounded by a braided fibre reinforcement layer 20". An extruded outer jacket or sheath 22' is also provided. This arrangement provides a double skin of metallic layers around the fluid hose, thereby to substantially minimise/eliminate permeation therethrough/ thereinto.

Figure 5 shows a view of a multi-conduit umbilical indicated by reference number 26 (according to the invention), which umbilical 26 comprises a plurality of individual fluid conduits 10, the conduits being according to the other aspect of the invention described above with reference to Fig. 2 to 4. The fluid conduits 10 are bundled 28 together and each of the individual fluid conduits will have different characteristics. In the example shown there are conduits for transporting ethanol, conduits for transporting wax

inhibitors, corrosion inhibitors, scale inhibitors, hydrate inhibitors, hydraulic control fluid, all of which are bundled together and provided with hose reinforcement structure 30 comprising a multiplicity of metal wires 32 arranged helically around the bundle 28. A second layer of helically wound metal wires 34 (wound in the opposite direction) provides resistance to crushing/kinking. An outer layer of plastics material 36 sheaths the whole of the umbilical 26.

In addition to the various conduits described there is included power cabling 38 and fibre optic cabling 40 for communication purposes.

Various modifications may be made to the above described embodiments without departing from the scope of the present invention and thus for example, instead of using an electro-plated layer and a metallic tape/film layer, there may be used several metallic tape/film layers spaced apart by the extruded polymer layers/taped polymer layers or combinations thereof.

CLAIMS

1. A fluid conduit for the transportation of chemicals with small molecular size and shape, eg, methanol, ethanol and hydrocarbon fluids and which is suitable for use in a multi-conduit umbilical, which conduit comprises a generally flexible fluid hose encapsulated by at least one metallised layer formed and arranged to substantially minimise permeation therethrough of fluid being transported in said fluid hose and, in use, in a multi-conduit umbilical to substantially minimise permeation into said fluid hose from adjacent hoses containing chemicals, characterised in that sections or lengths of said fluid hose have differing levels of encapsulation, and thereby permeation, along a given length thereof according to the operational requirements of the fluid conduit/umbilical.

2. A fluid conduit according to claim 1 wherein said metallised layer comprises at least one layer of metal, and which metal is selected from the group including copper, nickel, chrome, aluminium and alloys thereof.

3. A fluid conduit according to claim 1 or claim 2 wherein said metallised layer (or layers) is applied to the fluid hose by any suitable means including electroplating or spraying of metallised material onto the outer surface of the fluid hose or by applying a metallised tape therearound.

4. A fluid conduit according to any one of claims 1 to 3 wherein said encapsulation of the fluid hose is at predetermined positions/lengths along a fluid conduit.

5. A fluid conduit according to any one of claims 1 to 4 wherein said fluid hose is selected from the group of materials including polyethylene, cross-linked polyethylene, polyamide or flouropolymers.

6. A fluid conduit according to any one of claims 1 to 5 wherein said metallised layer has a thickness in the range of from 2 microns to 2 mm.

7. A fluid conduit according to any one of claims 1 to 6 wherein said fluid hose is formed by a continuous extrusion process.

8. A fluid conduit according to any one of claims 1 to 7 wherein said fluid hose is a one piece extrusion having a length in excess of 50 km.

9. A fluid conduit according to any one of claims 1 to 7 wherein said fluid hose is a one piece extrusion having a length in excess of 100 km.

10. A multi-conduit umbilical comprising a plurality of fluid conduits according to claim 1 bundled together and provided with at least one of a hose reinforcement structure surrounding said bundle of fluid conduits and an outer sheath.

11. A multi-conduit umbilical according to claim 10 wherein at least one of said plurality of fluid conduits has differing levels of encapsulation and thereby permeation rates than an adjacent fluid conduit.

12. A multi-conduit umbilical according to claim 11 which includes at least one of a power cable; fibre optics cable, and other fluid transportation hoses.

13. A multi-conduit umbilical according to any one of claims 10 to 12 having a length in excess of 50 km.

14. A multi-conduit umbilical according to any one of claims 10 to 12 having a length in excess of 100 km.

Application No:	GB 0229180.5	**Examiner:**	Damien J Huxley
Claims searched:	1 to 14	**Date of search:**	9 June 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
A	1	US 2002/0056481 A1	(YOKOHAMA RUBBER CO) see the whole document.
A	1	US 5271977	(BRIDGESTONE CORP) see the whole document.
A	1	EP 1020673 A1	(TOKAI) see the whole document
A	1	US 4570680	(RATTI) see the whole document.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[V]:

F2P

Worldwide search of patent documents classified in the following areas of the IPC[7]:

F16L

The following online and other databases have been used in the preparation of this search report:

ONLINE: WPI, EPODOC, JAPIO